## REMARKS/ARGUMENTS

Favorable reconsideration of this application in light of the present amendments and following discussion is respectfully requested.

Claims 1-69 are presently active. Claims 1, 32, 63, and 66 have been presently amended.

In the outstanding Office Action, Claims 1-69 were provisionally rejected under the judicially created doctrine of obviousness-type double patenting over Claims 1-44, 1-58, 1-48, 1-78, and 1-62 of co-pending Application Nos. 10/673,138; 10/673,467; 10/673,501; 10/673,507; 10/673,583; and 10/673,583, respectively. Claims 1-25, 32-56 and 63-69 were rejected under 35 U.S.C. § 103(a) as being obvious over Sonderman et al (U.S. Pat. No. 6,802,045) in view of Kee et al (U.S. Pat. No. 5,583,780). Claims 26-31 and 57-59 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Sonderman et al and Kee et al in view of Fatke et al (U.S. Pat. Appl. No. 200510016947).

**Regarding the rejection on the merits:**

As clarified, Claim 1 defines a method for analyzing a process performed by a semiconductor processing tool including:

> 1) inputting process data relating to an actual process being performed by the semiconductor processing tool,
> 2) inputting a first principles physical model including a set of computer-encoded differential equations, the first principles physical model describing at least one of a basic physical or chemical attribute of the semiconductor processing tool,
> 3) performing a first principles simulation for the actual process being performed ***during performance of the actual process*** using the physical model to provide a first principles simulation result in accordance with the process data relating to the actual process being performed in order to simulate the actual process being performed; and
> 4) using the first principles simulation result ***obtained during the performance of the actual process*** to determine a fault in the actual process being performed by the semiconductor processing tool.[1]

[1] The enumerations have been added purely for the purpose of referencing these elements for discussion.

The Office Action states on page 14 that it is common knowledge to practitioners in the art to recognize that performing the simulation environment (a first principles simulation) is performing the simulation environment for the actual process being performed. Thereafter, the Office Action refers to Sonderman et al (col. 5, lines 47-55) and asserts that Sonderman et al clearly teach the claim limitation of performing first principles simulation for the actual process being performed.

Sonderman et al at col. 5, lines 47-55, state that:

> Referring now to FIGS. 1 and 2 simultaneously, one embodiment of an interaction between a process control environment 180, a manufacturing/processing environment 170, and a simulation environment 210 is illustrated. ***In one embodiment the process control environment 180 receives input data from the simulation environment 210, which is then used to control the operation of the manufacturing environment 170.*** The integration of the simulation environment 210 and the process control environment 180 into the manufacturing environment 170 facilitates more accurate control of the processing of semiconductor wafers. The simulation environment 210 allows for testing various manufacturing factors in order to study and evaluate the interaction between the manufacturing factors. This evaluation can be used by the system 100 to prompt the process control environment 180 to invoke more accurate process control. [emphasis added]

Yet, other sections of Sonderman et al must be considered to decide if the process control environment 180 in Sonderman et al receives input data that is simulated based on historical or actual data of the process being controlled.

Below is a reproduction of the various relevant disclosures of Sonderman et al including inserted comments in **[bold brackets]** which point out that the simulations of Sonderman et al are not simulations based on data for an actual process being performed, but rather are based on historical data from preceding process runs. Sonderman et al disclose that:

> Once the system 100 performs the process simulation function, the system 100 performs an interfacing function, which facilitates interfacing of the simulation data with the process control environment 180 (block 430). The process control environment 180 can utilize the simulation data in order to

> modify or define manufacturing control parameters that control the actual processing steps performed by the system 100. Once the system 100 interfaces the simulation data with the process control environment 180, the system 100 then performs a manufacturing process based upon the manufacturing parameters defined by the process control environment 180 (block 440). **[Note that the process control of the current process is based on a pre-existing simulation similar to the approach taken by Kee et al of record.]** Col. 6, lines 35-47.
>
> Turning now to FIG. 6, in one embodiment, the system 100 defines the models 310, 320, 330 for execution by the simulator 340. The system 100 then validates the defined models (block 620). **[Note that the need to validate the models also means that the simulation results are based on pre-existing model solutions based on historical process data.]** In other words, the system 100 integrates the defined models, such as the device physics model 310, the process model 320, and the equipment model 330, into a single manufacturing unit that is controlled by the simulator 340. Using the validated models, the simulation environment 210 can emulate the operations of an actual process control environment 180 that is integrated with a manufacturing environment 170. Col. 6, line 64, to Col. 7, line 7.
>
> Once the system 100 validates the defined models, the system 100 acquires data to operate the defined models (block 630). In one embodiment, the system 100 acquires data from the computer system 130 in order to operate the defined models. The system 100 then populates the defined models with the data acquired by the system 100 for operation of the models (block 640). In other words, the system 100 sends operation data, control parameter data, simulation data, and the like, to the defined models so that the defined models can perform a simulation as if an actual manufacturing process were being performed. **[Note that if Sonderman et al were simulating an actual manufacturing process, then the disclosure here would not have stated "<u>as if</u> an actual manufacturing process were being performed."]** The completion of the steps described in FIG. 6 substantially completes the step of preparing process models for simulation, as indicated in block 510 of FIG. 5. Col. 7, lines 8-20.

Accordingly, Applicant submits 1) that the process control in <u>Sonderman et al</u> is based on control parameters developed on historical data and 2) that these disclosures of <u>Sonderman et al</u> do not disclose and indeed ***teach away*** from the presently claimed invention in which a first principles simulation is performed for the actual process being performed ***during performance of the actual process*** in order to simulate the actual process being performed.

Corroborating this assessment, <u>Sonderman et al</u> specifically discloses at col. 9, lines 46-51, that:

> The system 100 then optimizes the simulation (described above) to find more optimal process target ($T_i$) for each silicon wafer, $S_i$ to be processed. These target values are then used to generate new control inputs, $X_{Ti}$, on the line 805 to control ***a subsequent process*** of a silicon wafer $S_i$. The new control inputs, $X_{Ti}$, are generally based upon a plurality of factors, such as simulation data, output requirements, product performance requirements, process recipe settings based on a plurality of processing tool 120 operating scenarios, and the like. [emphasis added]

Once again, Applicant submits that the process control in Sonderman et al is based on control parameters developed on historical data (i.e., data taken from a previous run and applied to control of a subsequent process).

Finally, with regard to the process control in Sonderman et al, reproduced below is Figure 4 of Sonderman et al which in Applicant's assessment clearly shows that the simulation results are produced ahead of performing a process and thus have to be based on historical data.

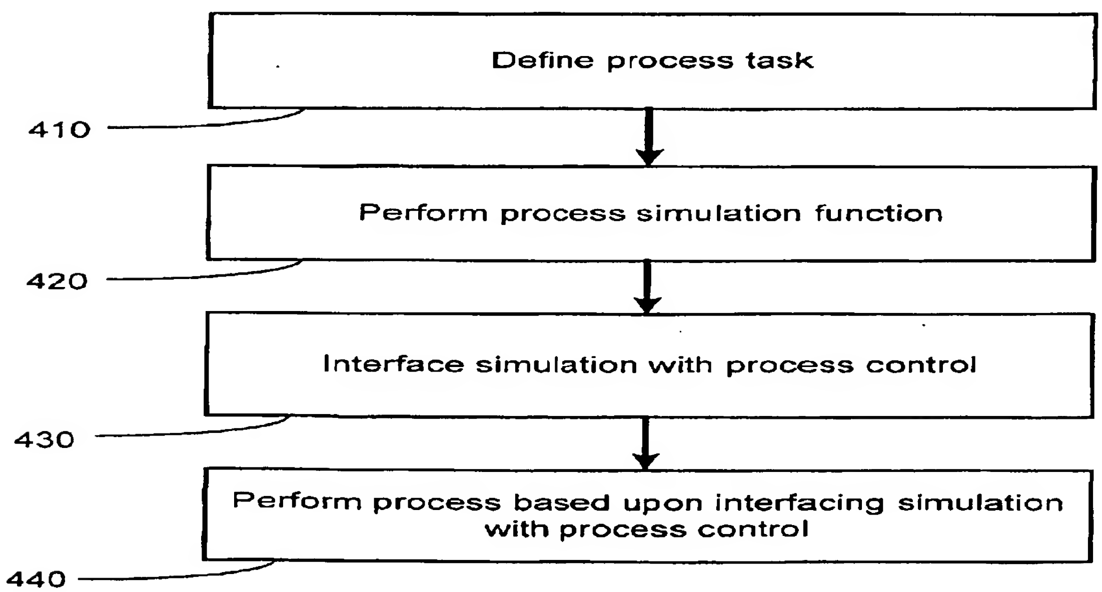


**FIGURE 4**

Thus, Sonderman et al do not disclose and indeed ***teach away*** from the presently claimed invention.

Furthermore, the deficiencies in Sonderman et al are not overcome by Kee et al. In the present case, the Office Action in rejecting the present claims supplements the teachings of Sonderman et al by the teachings of Kee et al.

Kee et al in detail disclose that:

> The modeling apparatus 101 of the instant invention may also be used to perform an inverse analysis to establish the boundary conditions or parameter values required to achieve a certain function of the thermal system. This allows the apparatus to be used to establish the appropriate process parameters and boundary conditions for the thermal system modeled. In accordance with the instant invention, the inverse analysis can be directly carried out by the modeling apparatus ***rather than using the conventional approach, which merely solves the direct problem repeatedly, in a lengthy and costly iterative process***, to determine appropriate input parameters to achieve a desired result. In other words, in accordance with the instant invention, ***once a particular thermal process is modeled for a particular set of control parameters***, the device may then be used to automatically obtain the necessary control parameters to achieve a desired result by providing the modeling apparatus with parameters corresponding to the desired result.
>
> To carry out the inverse analysis, the modeling apparatus 101 includes an inverse parameter input section 104 also connected to input device 103. A user inputs into the modeling apparatus 101 parameters corresponding to desired results, e.g., desired temperature characteristics of the system, which are stored in memory 108. The processing unit 110, under control of modeling program 111, ***uses the previously generated model*** of the thermal system and the parameters held in memory 108 and derives or predicts particular control parameters to meet the constraints entered through the inverse parameter input section 104. This process is more fully described below in connection with the examples provided.[2] [emphasis added]

Hence, Applicant submits that one of ordinary skill in the art at the time of the present invention would have recognized that 1) Kee et al disclose the use of radiation models to predict the spectral radiation transport in thermal systems, 2) that Kee et al explicitly disclose that the ***predicted*** model of the thermal system is used to design and control the thermal system, 3) that Kee et al exemplify that the difficulties of a conventional approach which

[2] Kee et al, col. 4, lines 21-50.

merely solves the spectral radiation transport equations through repeated, lengthy, and costly iterative process, and 4) that these problems force one, as Kee et al disclose, to use ***pre-generated model results*** for a control process.

Thus, at most a combination of Sonderman et al and Kee et al (if proper) would only use historical data to simulate and to provide process control for subsequent process runs based on prior-obtained simulation results (i.e., the pre-generated model results), ***not performed*** during the actual process.

Lastly, Applicant submits that one of ordinary skill in the art at the time of the present invention, aware as Kee et al were of the lengthy and costly iterative process to directly solve first principles models differential equations, ***would not have been motivated*** to apply the teachings of Kee et al to Sonderman et al in order to solve a differential equation for a semiconductor processing tool ***during performance of the actual process***, as presently claimed.

Thus, for at least these reasons, independent Claims 1, 32, 63, and 66 (and the claims dependent therefrom) are believed to patentably define over Sonderman et al and Kee et al

**Regarding the provisional double-patenting rejection:**

Applicant submits that a terminal disclaimer can be filed, if the claims in the present application and the claims in the co-pending Application Nos. 10/673,138; 10/673,467; 10/673,501; 10/673,507; 10/673,583; and 10/673,583 remain obvious in view of each other at the time of allowance of either of these applications. Indeed, M.P.E.P. § 804.02 IV states that, prior to issuance, it is necessary to disclaim each one of the double patenting references applied. Hence, Applicant respectfully requests that the examiner contact the undersigned should the present arguments be accepted and should the case be otherwise in a condition for

allowance. At that time, a terminal disclaimer can be supplied to expedite issuance of this case.

**Conclusion:**

As discussed above, the issues identified in the outstanding Office Action for this patent application have been addressed, placing all the claims in a condition for allowance.

Consequently, in view of the above discussions, the application is believed to be in condition for formal allowance. An early and favorable action to that effect is respectfully requested.

Respectfully submitted,

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